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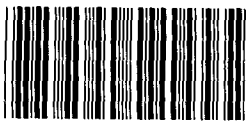

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RICHARDSON FLATS TAILINGS SITE
SUMMIT COUNTY, UTAH
TDD #T08-9207-019

TAT Response to Pioneer Technical Services, Inc.
Comments and Observations Report
Dated July 13, 1992

ITEM I

A. TAT selected drill locations for the proposed monitoring wells based on a site background review, field observations, and the proposed monitoring well locations identified in the approved Sampling QA/QC Work Plan, dated May 28, 1992. On June 15, 1992, UPCM submitted comments regarding this work plan and there were no objections expressed relating to the proposed monitoring well locations. In addition, at no time prior to the drilling of well RF-MW-02 was TAT advised by UPCM employees that the location selected was within the former municipal landfill boundary.

TAT's intention was to locate both downgradient monitoring wells immediately adjacent to the landfilled area in order to detect contaminant releases. During the drilling and sampling process it was determined that the location selected was within the landfilled area. TAT proceeded to drill at this location in order to characterize subsurface water conditions in the uppermost aquifer beneath the landfill. Additional information was thereby gained concerning subsurface strata at this location.

Contrary to statements made by the consultant, there are no references in EPA guidance or State of Utah administrative regulations prohibiting drilling in landfills. TAT believes that well RF-MW-02 is actually located in an optimum location in order to detect leachate emanating from beneath the landfill.

B. Based on the review of local geologic literature and field data gathered, no information was produced to substantiate the consultant's claims that the clay layer encountered beneath the landfill is in fact a continuous unit or that the clay isolates the landfill materials from vertical contaminant/waste migration. The consultants reasoning for suggesting that the groundwater is confined or even semi-confined appears to be based on misinterpreted observations and not sound hydrogeologic principles. None of these allegations made by the consultant are yet proven or even appear likely.

The deposits encountered during drilling can be classified as unconsolidated quaternary alluvial deposits. The literature states that these unconsolidated deposits consist of a poorly sorted mixture of material ranging in size from clay to boulders, and all beds appear to be lenticular and discontinuous (Holmes, 1985; Baker, 1970). There appears to be no well-defined beds of material of very high or very low permeability, and no indications

of the existence of artesian conditions. The unconsolidated deposits are saturated to within a few feet of the land surface with unconfined groundwater (Baker, 1970).

The amount of data gathered during this limited field investigation (installation of three monitoring wells) is insufficient to characterize with any certainty the geology and hydrogeology of the area. Considering the alluvial depositional environment, TAT believes that additional soil borings/boreholes, monitoring wells, and a geophysical survey would be necessary to sufficiently provide a detailed understanding of the hydrogeologic and geologic regime beneath the landfill. Only with additional information could one expect to properly correlate stratigraphic units, identify confining layers, zones of possible high or low hydraulic conductivity, and identify any unusual or unexpected geological features, such as stream channels, clay lenses, or sharp changes in grain size, etc., beneath the landfill area.

The consultant suggests that the groundwater is under pressure and displays artesian conditions because in each monitoring well the water level rose above the level in which it was first encountered. TAT believes that this is simply due to the physical characteristics of the sediments encountered which were predominately fine silts and clays. The potentiometric surface does not stabilize immediately within that type of strata but does so after water has had ample time to slowly migrate through the fine sediments. The compression of clays against the borehole wall during drilling can also contribute to slow infiltration rates. The return of the potentiometric surface to its static level (24-hours later) is expected to occur gradually, as was observed in the field. The water levels generally rose to the point where moist drill cuttings were logged by the TAT during drilling activities. If artesian conditions existed at the site a rapid rise would be expected and the final water level would be above any confining layer present. This is not the case with any of the wells installed, on the contrary, subsequent water level measurements indicated a drop in water levels as would be expected during the seasonal fluctuation in unconfined aquifers.

Furthermore, UPCM's consultant states repeatedly that the landfill was dry prior to well installation. TAT does not believe that sufficient field data was available to determine if the landfill contents were dry. The literature describes the climate of the area as sub-humid, with annual precipitation ranging from 20 to 25 inches (Gill, 1984; Haws, 1970). Recharge to the unconsolidated deposits comes primarily from the direct infiltration of precipitation and runoff from the surrounding mountains (Baker, 1970). During drilling TAT encountered moist refuse which was derived directly from the landfilled area. A newspaper article obtained by the TAT indicated that the landfill was plagued by accidental fires when in operation, and on one occassion the fire department poured 60,000 gallons of water on smoldering rubbish in the landfill.

TAT found no evidence during drilling suggesting that the landfill was properly capped following its closure. TAT believes that water must have entered the landfill as a result of infiltration of precipitation and snowmelt through the existing permeable cover. Subsequent percolation through the contaminated materials would produce leachate which commonly pools within certain low spots of the landfill or is possibly migrating into the underlying groundwater. The fact that no leachate seeps have been observed suggests that the clay layer is in fact not continuous or impermeable, does not act as a confining layer, and is permitting leachate to flow beneath the base of the landfill into the local groundwater. If a clay cap and liner of low permeability had been installed over the waste disposal area TAT would expect a reduction of surface water infiltration thereby minimizing leachate generation from meteoric waters. It is impossible to imagine the contents of the landfill ever being dry as speculated by the consultant, based on the inadequate cover observed during drilling and on the questionable properties of the allegedly "continuous" clay layer beneath the landfill.

The TAT is unaware of any engineering or geotechnical studies concerning both the natural clay layer beneath the landfill or the cover of the landfill. Soil properties such as thickness, grain size, permeability, plasticity index, and compaction density measurements, etc., would be required to determine if the clay beneath the landfill even displays confining capabilities. Also, the integrity of natural clay liners is suspect because they can display variable hydraulic conductivities, can be fractured or cracked during the filling of the landfill, and certain organic liquids and strongly acidic wastes can cause degradation of the clays leading to significant increases in permeability. This is to name but a few problems associated with natural clay barriers.

UPCM's consultant raises a question concerning the location of the base of the landfill relative to the bentonite seal which was installed to inhibit fluid migration between these zones. Based on careful geologic logging of drill cuttings, split spoon sampling, and communication with the driller during the advancement of well RF-MW-02, TAT is certain that the base of the landfill is located between 25 feet 6 inches and 26 feet below ground surface (bgs). The base of the bentonite seal currently rests at 26 feet bgs, thus the bentonite is creating a seal one-half foot into the clay unit or is possibly resting directly at the contact. The TAT believes that the uncertainty regarding the exact location of the clay/bentonite interface does raise a reasonable concern regarding the completion of well RF-MW-02. However, the consultant's allegation that EPA/ERB and E & E has flooded the landfill is unfounded. All water level measurements taken during the drilling and on a subsequent sampling trip clearly show that the water level has never risen past the level of the bentonite seal. On June 26, 27, and August 5, 1992, the groundwater level was measured to be 26 feet 6 inches, 26 feet 4 inches, and 26 feet 11 inches bgs, respectively. Therefore, no

water has ever been introduced into the landfill via the process proposed by the consultant.

A review of literature for this area indicates water level fluctuations are characterized by rapid water level rises in the spring and summer followed by gradual declines during the fall and winter. Generally, water level fluctuations are smaller in wells located further to the northeast of Silver Creek (Mason, 1989). The majority of precipitation falls as snow during November through April. The driest period is generally May through September, when less than 8 inches of precipitation falls (Gill, 1984). Field measurements obtained by the TAT show a decreasing trend in the water level which is expected to continue until next spring. TAT suggests that due to the uncertainty surrounding this well, and the fact that groundwater levels are expected to rise following spring snowmelts, the final disposition of this well be addressed prior to the spring of 1993.

UPCM's consultant also alleges that the other two wells installed (RF-MW-01 and RF-MW-03) breached the clay unit and were not properly repaired. TAT is certain that both wells, RF-MW-01 and RF-MW-03 were properly installed and completed, thus preventing the vertical migration of groundwater via the wells. Note that during drilling, various clay zones differing slightly in texture, color, etc., were encountered. Those zones varied in thickness and are likely working collectively as an aquaclude. The presumption that any specific clay layer or zone can be pinpointed as the top of the aquiclude within this type of geological sequence, or stratified aquaclude, is unacceptable. As stated above, both wells were properly sealed within the clay sequence below any buried debris and well above the stabilized static water level. These wells will not serve as a conduit between the aquifer and upper units or vice versa.

ITEM II

A.1. On June 23, 1992, at 1015 hours Tom Giles (Driller) of Boyles Brothers Drilling Company informed TAT that the drill rig and equipment was decontaminated using water from the Salt Lake City municipal drinking water supply. Prior to the initiation of drilling activities TAT directed the drillers to decontaminate casing and drill rods that were to be utilized during the drilling. At 1050 hours the drillers cleaned this equipment with a high pressure wash. TAT inspected the drilling equipment and determined that they were thoroughly decontaminated prior to the drilling of well RF-MW-01. The drilling subcontractor concurs with TAT stating that all drilling equipment was clean (see Attachment B).

A.2. The drilling subcontractor states that the driller's helper did in fact properly decontaminate the hammer bit prior to it being used (see Attachment B). TAT members recall that this activity was performed as stated by the drilling subcontractor.

A.3. Acetone was used during the decontamination of the drilling equipment. TAT's decontamination protocol is stated in the bid specification package and calls for a water rinse following the application of acetone. This water rinse was not specifically documented by TAT during the decontamination procedure of equipment used for well RF-MW-02. The drilling subcontractor believes that a final rinse was in fact performed prior to drilling at all locations (see Attachment B).

TAT chemists state that any residual acetone on the drill string would be expected to volatilize due to the slight heat, air pressure, agitation, and cuttings exiting the bore hole during the drilling process. Also, the acetone would be non-detectable in any subsequent groundwater samples collected.

A.4. The drilling subcontractor states that the fiberglass tape used to determine the level of completion materials within the casing was in fact decontaminated between boreholes (see Attachment B).

B. TAT believes that the integrity of samples collected from the wells should not be considered compromised based on observations alleged by the PRP's consultant. The drilling subcontractor disagrees with the consultant and states that all materials used were clean prior to being placed in the borehole (see Attachment B).

C. The TAT carefully considered all drilling methods for this project prior to the initiation of the bidding process. A review of pertinent literature for this area indicated that the Odex method (air rotary/casing drive) would be the appropriate method of drilling based on anticipated well depth and suspected complications of drilling through cobble and boulder laden beds. Safety was not compromised during drilling as all material exiting the borehole was continuously and closely monitored with a combination hydrogen sulfide/oxygen content/and combustible gas detector which was mounted on the rear of the drill rig adjacent to the borehole. An HNu photoionization instrument was also used to monitor cuttings, samples recovered from split spoons, and air within the casing and in the breathing zone near the borehole. Also, all non-essential personnel (UPCM employees and their consultant) were directed by the E & E Health and Safety Officer not to approach the immediate drill rig area.

ITEM III

A.1. The drilling method selected by the TAT was adequate and did allow for proper completion of the monitoring wells allowing the unobstructed entry of formation waters into the wells. The portion of holes drilled with the Odex hammer provided an annular space approximately 6 inches in diameter. Due to the difficulty of drilling conditions encountered within the clay unit, TAT approved the use of a tri-cone bit which produced an annular space

approximately 4 inches in diameter. TAT believes that the boreholes created did allow for a reasonable distribution of filter pack materials around the well.

A.2. Prior to the initiation of borehole drilling it was anticipated that the proposed wells would not exceed 35 feet in total depth. Well RF-MW-02 was drilled to a total depth of 39 feet bgs, but minor caving allowed the well screen and casing to be placed to only 38 feet bgs. TAT correctly followed E & E's SOPs for monitoring well installation which recommends centering guides to be used only when well casing and screen assemblies exceed 40 feet in length.

The filter pack used (10-20 mesh) was properly selected by the TAT. The extremely fine grained sand filter pack suggested by the PRP consultant would have very limited utility because it would have rapidly become clogged by clay particles being removed from the well.

A.3. TAT's response to the selection of an appropriate method of drilling can be found in Item II, C. and Item III, A.1. TAT disagrees with the consultant and believes that no significant caving occurred during the drilling of the boreholes as would be expected from the nature of material encountered. A total of one foot of material was observed to have caved back into boreholes for wells, RF-MW-02 and RF-MW-03. The consultants allegation that clay/silt is in direct contact with the screen is speculative and not supported by any direct evidence. The volume of sand pack required for each well was calculated by the drilling subcontractor and the amount used agreed with the calculations, indicating that no caving occurred (see Attachment B).

A.4. As completion materials (i.e., sand, etc.) were added to each borehole the casing was removed only enough to allow the material to backfill the vacated portion of the bore hole, thereby eliminating the possibility of any open space within the bore hole. For additional comments see the driller's statement included in Attachment B.

B.1. TAT believes that during the drilling operations and well development activities all equipment that entered the well was cared for so as not to introduce any contamination. In the case of drilling equipment, all drill rods and casing that were used in the boreholes were placed on the equipment racks provided by the drilling subcontractor. TAT believes that it is possible that some equipment (i.e., development bailer and water level indicator) may have been placed on the recently poured concrete pads and, even though it was contrary to standard protocol, this practice should not have transferred any contaminants into the wells.

The drillers state that all equipment entering the borehole was cleaned and not left on the ground (see Attachment B). TAT does note that some incidental equipment (i.e., pipe wrenches and

cheater bars) were placed on the ground surface during the drilling process.

B.2. The driller's helper was in fact smoking on-site. E & E does not permit this practice within the exclusion zone, but he was doing so at what was deemed a safe distance from the borehole, which was being continuously monitored for explosive gases. For additional comments see the drillers statement included in Attachment B.

B.3. During well development the driller's helper was noted wearing green nitrile gloves, however he did take them off between wells and may have touched the rope with bare hands. The bailer and rope may have been set on the newly poured concrete pad but not on the ground. TAT admits this is not standard practice, but should have not contaminated the wells.

B.4. The equipment used for water level measurements does allow for only relative accuracy. The TAT believes that all measurements obtained to be accurate within one inch of the recorded value and appropriate for the well development process. When the sampling team returned to the wells on August 5, 1992, very precise measurements (nearest hundredth of an inch) were obtained with a different instrument.

B.5. The monitoring wells were developed according to E & E SOPs for well development and EPA guidelines. It was TAT's intention to develop the wells until the water was free and clear of sediments, however due to the fine grained nature of the sediments encountered the wells will likely contain some suspended sediment throughout the operational life of the wells and no amount of development can be expected to alter this. The TAT recommends that as slow a rate of bailing or pumping as is possible be used to purge and sample these wells, with as little disturbance as possible. Ideally, a peristaltic pump should be used where the water table is shallow enough and the well pumped at 0.2-0.3 liters/minute.

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UNITED PARK CITY MINES COMPANY
309 KEARNS BUILDING
SALT LAKE CITY, UTAH 84101

VIA FAX TRANSMITTAL & CERTIFIED MAIL - RETURN RECEIPT

July 29, 1992

Mr. Mike Zimmerman, Environmental Protection Specialist
U. S. Environmental Protection Agency
Region VIII (8HWM-ER)
999 18th Street, Suite 500
Denver, Colorado 80202-2405

Dear Mr. Zimmerman:

This letter is written to notify the U. S. Environmental Protection Agency ("EPA") that the monitoring wells which were installed by EPA's contractor, Ecology and Environment, Inc. ("E&E"), were improperly constructed and completed, and have resulted in the potential contamination of local groundwater.

During the period of June 23 through June 27, 1992, EPA's contractor, E&E, drilled one monitoring well directly in the Park City Municipal Corporation landfill ("Landfill") against the advice of United Park City Mines Company ("United Park") and its consultants, Pioneer Technical Service, Inc. ("Consultants") and against EPA guidance. EPA's contractor, E&E, drilled this monitoring well directly through the Landfill and breached the impervious clay layer which had formed a continuous barrier between the Landfill materials and the underlying groundwater. The formerly continuous clay barrier was not repaired by E&E during completion of the monitoring well; thereby, allowing the underlying groundwater to flow up the well under pressure, out through the filter pack along the top of the clay barrier and into the formerly dry Landfill. When this water discharges from the base of the Landfill, either as springs or to Silver Creek, it will be contaminated by whatever is in the Landfill.

Before the installation of this monitoring well, the Landfill was isolated from the groundwater. EPA and its contractor, E&E, have breached the impervious, natural clay barrier and are fully responsible for the ensuing groundwater and surface water contamination.

Likewise, the other two monitoring wells also breached the impervious clay barrier and the clay barrier was not properly repaired in either of these monitoring wells. The result of not properly repairing the clay barrier is again, the

upward migration of the formerly confined groundwater into formerly dry geological formations or construction debris and Landfill material and eventually out of the Landfill area to surface water.

These events and problems are more fully detailed in our Consultant's report which is attached hereto.

Due to the very serious nature of these problems, we strongly recommend and will expect that these monitoring wells not be sampled during your proposed investigation of Richardson Flat and that all three monitoring wells be correctly plugged and abandoned as soon as possible.

Your prompt attention to these very serious problems will be appreciated.

Yours truly,

Edwin L. Osika, Jr.
Executive Vice President

ELO,Jr./rfwel

encl.

cc: Region VIII Director

I. SERIOUS VIOLATIONS OF SOP'S AND EPA GUIDANCE REGARDING INSTALLATION OF GROUNDWATER MONITORING WELLS:

A) MONITORING WELL MW-2 WAS INSTALLED WITHIN THE BOUNDARY OF THE HISTORIC PARK CITY LANDFILL, CONTRARY TO USEPA GUIDANCE.

The most blatant violation of EPA guidance in the drilling of these monitoring wells was the placement of well MW-2 within the boundary of the historic landfill (see Figure 1). USEPA direction is clear - drilling directly through municipal landfills is to be avoided in order to protect underlying groundwater, and for obvious safety considerations; rather, drilling is to be conducted off of the actual landfill and downgradient from it. Prior to drilling, the TAT was advised by the property owner (UPCM) that the location selected for MW-2 was within the former landfill boundary. For whatever reasons, the TAT declined to relocate the well 100 feet to the north, out of the former landfill. After drilling five to ten feet, drill cuttings and split-spoon sample cores showed that the borehole was obviously within the landfill.

At this point, the proper procedure would have been to properly abandon the borehole, move off the landfill, and drill a new borehole in a safer location; however, the TAT persisted with drilling in the landfill. If TAT had adequate training and experience in hydrogeology, they would have anticipated the potential for problems arising from drilling through a landfill, and chosen to drill elsewhere. TAT's lack of experience and refusal to follow USEPA policy, resulted in one of the most serious monitoring well installation calamities possible (described below).

B) THE MONITORING WELL COMPLETIONS ARE INAPPROPRIATE FOR THE HYDROGEOLOGIC CONDITIONS ENCOUNTERED AT THE LANDFILL SITE AND IN ONE CASE (MW-2), HAS RESULTED IN THE POTENTIAL CONTAMINATION OF LOCAL GROUNDWATER BY USEPA.

This is the most egregious violation of sound hydrogeologic practice and may have violated State of Utah regulations for monitoring wells, water wells, or groundwater protection. The drilling of all three monitoring wells showed that the underlying groundwater was a confined or semi-confined aquifer system. In each borehole, the saturated zones were found beneath a thick, apparently continuous aquitard that isolated the landfill materials from underlying groundwater system (see cross-section, Figure 2). In each of the three monitoring wells, the static water level rose to an elevation significantly higher than the level at which water was first encountered.

Borehole MW-1 (upgradient) first encountered this aquitard at 5 feet below ground surface (bgs) and the first groundwater at 16 to 18 feet below the surface (the base of the aquitard). The

borehole was deepened to 25 ft bgs and the well was completed; however, rather than installing 10 feet of screen to 15 ft bgs (near the first water), TAT put in 15 feet of screen, possibly interconnecting several discrete saturated zones. The following day, the water level had risen to only 8 feet bgs, clearly indicating that the underlying groundwater was under pressure.

After ill-advisedly locating well MW-2 within the former landfill (discussed above), drilling commenced. For whatever reason, the TAT did not closely monitor the drill cuttings from the borehole; however, UPCM's hydrogeologist was because of the geology observed at MW-1 and concern about breaching the aquitard underlying the landfill. At 25 ft bgs, a two-foot split spoon core revealed six inches of the aquitard (a reddish-brown clay) in the bottom of the core barrel, clearly showing the top of the aquitard to be at 25.5 ft bgs. The TAT erroneously recorded the top of this unit at 25 ft bgs. Drilling continued (slowly) and water was encountered between 34 and 35 ft bgs. The drilling was halted at 39 ft bgs and well completion activities began.

At this point, serious errors in judgment and perhaps criminal negligence, caused the completion of well MW-2 to be entirely inappropriate, if not illegal. First, 10 feet of screen were placed in the well, bringing the screened section up to 27.5 ft bgs, very close to the top of the aquitard unit. Then, the filter pack was brought up to 26 ft bgs, above the aquitard. The bentonite seal placed on top of the sand was intended to plug the aquitard; however, due to careless geologic logging, it completely missed the aquitard and provides no such seal. The formerly continuous barrier between the landfill materials and groundwater has been breached by the drilling and not repaired during well construction. Water level measurements on subsequent days show clearly that the underlying water is under pressure and has risen up the borehole to exactly 26.5 ft bgs, the top of the aquitard. The underlying groundwater is now flowing up the well under pressure, out through the filter pack along the top of the clay aquitard and into the base of the formerly dry landfill. When this water discharges from the base of the landfill, either as springs or to Silver Creek, it will be contaminated by whatever is in the landfill.

Prior to the installation of well MW-2, the landfill was isolated from the groundwater system. EPA and their TAT contractor have breached this natural compacted clay barrier and are thus solely responsible for the ensuing potential groundwater and surface water contamination.

Clearly, this would not have occurred had the following USEPA procedures been correctly followed:

- first, not drilling within the landfill would have avoided breaching whatever natural, compacted liner might exist beneath it;

II. VIOLATIONS OF SOP'S AND EPA GUIDANCE REGARDING INSTALLATION OF GROUNDWATER MONITORING WELLS THAT MAY AFFECT DATA QUALITY OR SAFETY:

A) IMPROPER AND INEFFECTIVE DECONTAMINATION OF DRILLING EQUIPMENT PRIOR TO PLACEMENT IN THE BOREHOLE.

On several occasions drilling equipment was placed into the borehole before being adequately decontaminated. Examples of this practice are listed below:

1) Prior to drilling well MW-1, the drill rig and pipe were allegedly decontaminated at "the shop". While this may indeed be the case, it is proper EPA procedure to decontaminate the drilling equipment on-site, in case any dust, fuels or other contaminants may have come into contact with the drill rig enroute to the site. When the pipe was off-loaded from the rig, several rods had visible petroleum contamination (oil or grease) on them. This was brought to the attention of the driller by UPCM, who then sprayed the rods with a high-pressure wash. The petroleum contamination was still not removed.

2) During the drilling of MW-3 (at 15 ft bgs), a different hammer-bit was placed on the drill string. This bit was loaded at the shop into the driller's oil/diesel-soaked pickup bed, driven to the site and never decontaminated prior to placing it in the borehole. TAT apparently wasn't aware that this occurred.

3) Decontamination of the drill pipe included a nonsensical light spraying (and evaporation) of acetone after steam cleaning. The purpose of the acetone rinse is to solubilize organic compounds and remove them from the pipe. By letting the acetone evaporate off the pipe, the contaminants remain. The only result of this ridiculous procedure then, is to contaminate the drill pipe with acetone.

4) An undecontaminated steel tape and weight was repeatedly placed in the well annulus to determine the depth to sand and bentonite during placement of the annular materials. Proper EPA procedure requires that anything entering the borehole be decontaminated prior to and after use in each borehole.

The result of these shortcomings may be that groundwater samples collected from these wells will contain petroleum compounds, acetone or other contaminants. These compounds will then be attributed to the landfill when, in fact, they have originated from improper decontamination of equipment during the well drilling and installation.

B) HANDLING OF WELL COMPLETION MATERIALS (SCREEN & SAND) AND PLACING OF SAND IN CONTAINERS OF UNKNOWN CLEANLINESS.

During the completion of all of the monitoring wells, the screened casing was lowered into the borehole by drilling personnel with dirty, oily hands. Also, the silica sand was handled with bare hands, placed in an undecontaminated hardhat, and poured into an undecontaminated funnel. The correct USEPA procedure is for the personnel to wear latex gloves while handling the casing, sand and anything else that is to be placed in the borehole, and to decontaminate everything that might come into contact with the water to be sampled. Any contaminants on the drilling personnel's hands (e.g. diesel fuel) may now be on the well casing and could be transferred to the groundwater sample. Anything the filter pack contacted may now be in the borehole, and may appear in subsequent sample analyses.

C) THE DRILLING METHOD CHOSEN WAS NOT APPROPRIATE FOR POTENTIALLY CONTAMINATED CUTTINGS AND WATER.

The drilling method chosen for these wells resulted in the driller and anyone within 10 feet of the drill being sprayed with cuttings and water. This could have been a problem had there been any contaminated cuttings (especially within the landfill) or groundwater, and should have been anticipated in the equipment requirements (drilling specifications). The driller rigged up a cone of plastic sheeting to deflect the cuttings but it was not effective once groundwater was encountered. While this shortcoming does not affect the sample quality, it is a serious safety concern.

III. SEVERAL SUBSTANDARD OR SLOPPY PRACTICES WERE OBSERVED THAT PROBABLY DO NOT SERIOUSLY COMPROMISE DATA QUALITY, YET BETRAY AN INDIFFERENT OR CARELESS ATTITUDE REGARDING THE QUALITY OF THE INVESTIGATION.

A) DESIGN SPECIFICATIONS FOR DRILLING EQUIPMENT, BOREHOLE AND WELL COMPLETIONS DO NOT ALLOW FOR A PROPER WELL INSTALLATION NOR A REPRESENTATIVE, SEDIMENT-FREE SAMPLE TO BE COLLECTED.

The specifications for drilling the borehole and for completing the monitoring well do not allow a proper well installation nor a representative groundwater sample to be collected from the completed well. Specific design specification problems include:

1) Drilling specifications called for a 4-inch inside diameter (id) borehole to be drilled and a 2-inch id monitoring well to be installed in the borehole. The schedule 80 PVC casing has an outside diameter (od) of 2.4 inches, which leaves only 0.8 inches on either side of the casing within the borehole. The tremie pipe

used to install the filter pack was 1.05 inches od, which only allows 0.55 inches on the other side of the casing for the filter pack. This is not a thick enough sand filter pack to keep suspended sediment from entering the well from the formation with groundwater. The result is a well that does not clean up during development and has excessive suspended sediment in water samples.

2) Centralizers were not used during well installation to keep the well casing centered in the borehole and assure that filter pack was evenly distributed around the well casing. Also, the filter pack size (10-20 mesh) was too large for the geology and screen size. The result is also excessive sediment in water samples.

3) The drill rig was too small and the bit was not appropriate for the geology encountered. A little research into the geology of the area would have shown that clay is an extensive part of the alluvial geology in the basin. The rig and bit could have been selected to accommodate this; however, significant drilling problems resulted from the use of this particular set up. The most detrimental to well construction was that the drill had to be advanced with an open borehole once the confining clay/silt unit was reached in holes MW-2 and MW-3. Thus, significant caving of the hole occurred prior to and during well installation. The result is the clay/silt formation is in direct contact with the screen, since the filter pack was placed as the formation caved; hence, the well did not clean up and samples will contain excessive suspended sediment derived from the formation clays and silts.

4) During well construction, the outer (4-inch) casing was pulled in 3- to 5-foot lifts, much too great to properly place annular materials. This also has the effect of allowing the formation to cave and contact the screened casing (lower depths) or the blank casing higher up. The result is either formation entering the screen as described above, or an inadequate seal around the blank casing allowing surface water to penetrate. This is a sloppy way to complete a well and results again in water samples full of suspended sediment.

The use of these improper specs and procedures can affect analytical results for those compounds that preferentially adsorb to sediments. The specs and procedures that should have been followed to obtain a properly functioning monitoring well are: a 6-inch borehole should have been drilled for the 2-inch well; centralizers should have been placed on the well casing; the correct sand size (16-40 mesh) should have been used in the filter pack; a drill rig and bit capable of drilling in this geologic setting (larger air rotary), advancing casing to the

total depth of the hole (casing driver), and containing drill cuttings and water; and, the outer casing should be pulled in 6-inch to 1-foot lifts, preventing formation from collapsing on the well casing. Using these practices results in a superior monitoring well and a more representative groundwater sample.

B) SEVERAL INSTANCES OF MINOR VIOLATIONS OF USEPA STANDARD OPERATING PROCEDURES WERE OBSERVED.

1) At several times equipment that was to later enter the well was placed on the unprotected ground surface. This included the development bailer, the depth indicator probe, and all the drilling equipment. This may have transferred contaminants into the well.

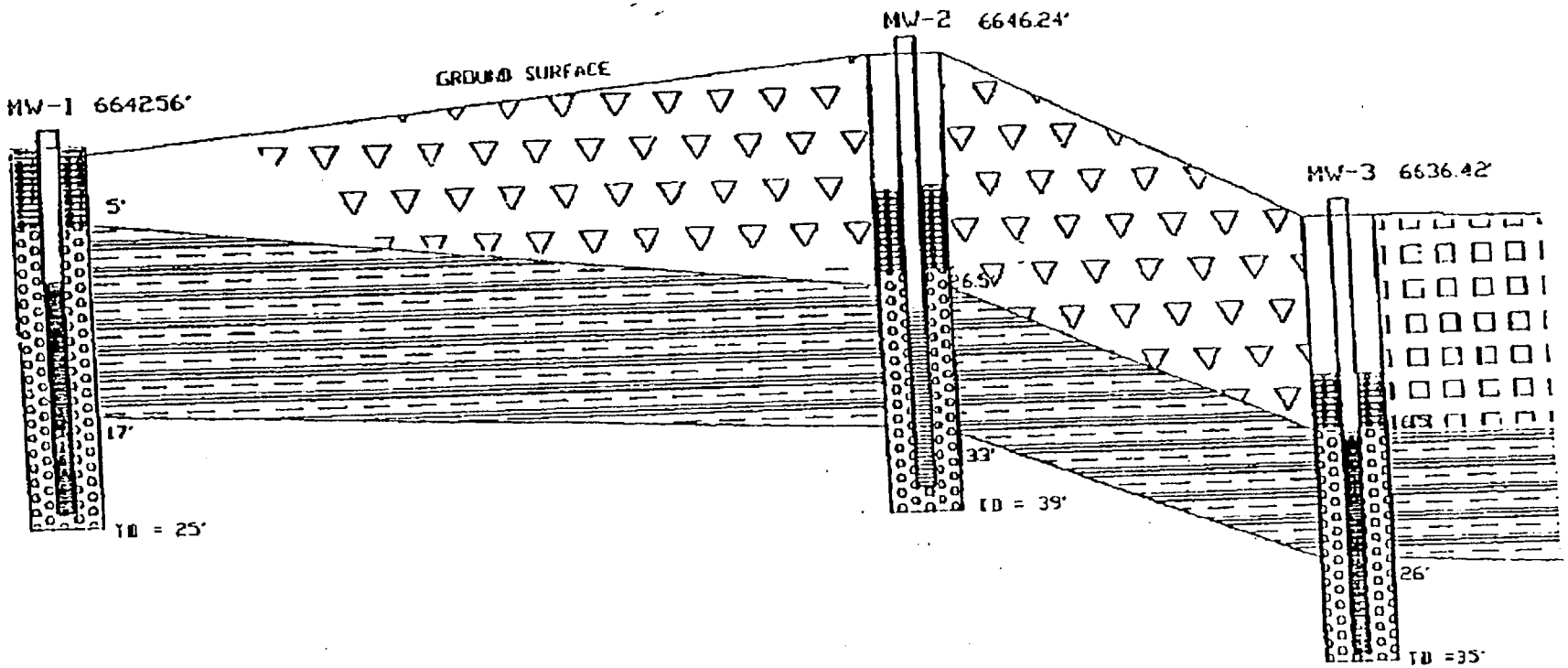
2) Throughout the drilling, the driller's helper was smoking cigarettes on and near the drill. This is a serious safety hazard considering that the generation of explosive methane is a common occurrence at municipal landfills, but was not addressed or corrected in the "safety meetings".

3) During development, the bailer rope was handled with bare hands and allowed to lie on the ground. This may also have transferred contaminants into the well.

4) Water level measurements were made several times. However, rather than measure to the nearest tenth or hundredth of a foot with a tape or the gauge on the side of the probe, the depth was visually estimated between the 1-foot markings on the probe. This results in inaccurate depth to water measurements.

5) Well development criteria were not clearly defined or technically correct. Wells are developed to remove the sediment, settle the filter pack, and begin the process of interstitial filtering within the filter pack. These criteria are not met by removing a fixed number of bore volumes, or with stabilization of pH and SC. The percent sediment used by TAT was a meaningless visual estimate and did not indicate adequate development, although sediment content is the only correct criteria to use. As a result, these wells are extremely dirty with excessive, formation-derived sediment. This may affect analytical results for those compounds that preferentially adsorb to sediments.

As indicated, these are minor violations of EPA procedures that assure safe and contaminant-free well installation. While these violations will probably not seriously affect the quality of the data from the investigation, they do indicate an indifferent attitude toward the standard procedures and their intended purpose (to assure high-quality sampling data).



RED-BROWN CLAY

MUNICIPAL LANDFILL DEBRIS

CONSTRUCTION DEBRIS/FILL

CLAYEY SAND OR SANDY/SILTY CLAY

BENTONITE PLUG

SAND PACK

FIGURE 2
GEOLOGIC CROSS SECTION AND LANDFILL MONITORING WELLS

PIONEER

DRAWING NO: 012-12
REV NO: A
DATE: 7/13/92
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

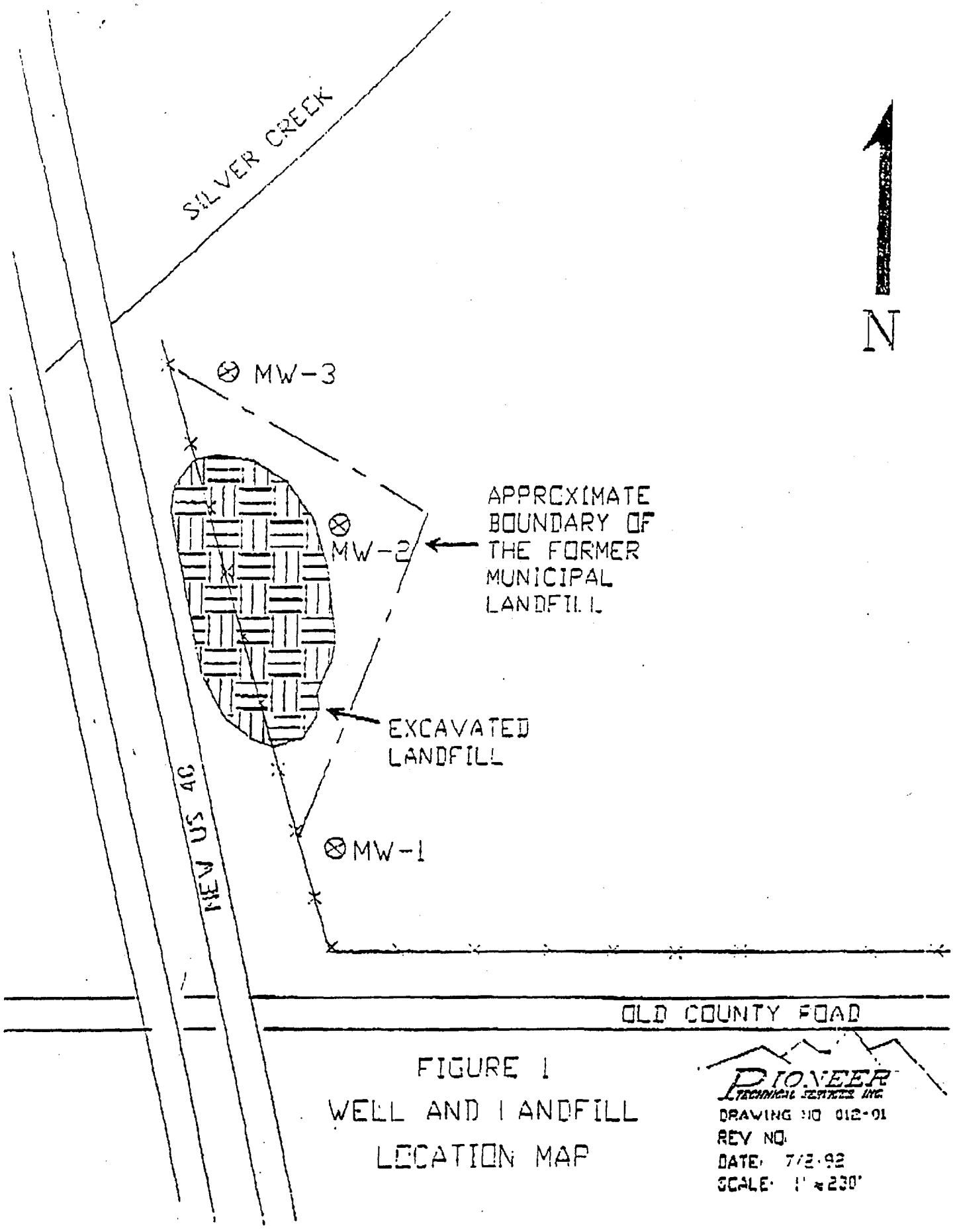


FIGURE 1
WELL AND LANDFILL
LOCATION MAP

PIONEER TECHNICAL SERVICES INC.
DRAWING NO 012-01
REV NO.
DATE: 7/2-92
SCALE: 1" = 230'

DRAFT

ATTACHMENT B

Letter: Boyles Brothers Drilling Company to
Ecology and Environment, Inc.
Dated: August 10, 1992

CBC
Boyles Bros. DRILLING COMPANY

GROUTING DISTRICT

1707 South 4490 West • P.O. Box 25068 • Salt Lake City, Utah 84125
(801) 972-3333 • Fax: (801) 972-6769

August 10, 1992

To: Troy Sanders
Ecology and Environmental

From: Ron Hall
Boyles Bros. Drilling

Re: Park City Landfill Project

After review of Pioneer Technical Services, Inc. report on well installation at United Park City Mines Landfill we offer the following information as it pertains to our involvement.

Page 11-Item #A1 - Our driller Mr. Tom Giles does not agree with this statement. All pipe and tools were decontaminated at the location of the previous job and again steam cleaned at our shop facilities and also before being used on site for hole #MW-1. He did say that there was a small amount of Hydraulic oil on two pieces of casing but were in fact cleaned on site before use. All drilling equipment was clean.

Page 11-Item #A2 - The bit used on MW-3 was in fact cleaned at the site before using. He remembers as Charlie (his helper) had to carry the bit & reamer from the de-con pad back to the hole. In addition his truck bed was and is not oil and diesel soaked.

Page 11-Item #A3 - Tom Giles has no specific remembrance of this statement but thought all pipe was rinsed after the acetone was applied.

Page 11-Item #A4 - The tape was a fiber glass tape. Tom claims it was in fact decontaminated between holes.

Page 12-Item #B - Our personnel disagree with this statement. Tom thought that they did wear gloves but not 100% sure. He is sure that their hands were not oily and dirty, as all the material was clean. The hardhat used to pour the sand into the casing (this is not our normal procedure but was done due to the height of the pipe) was brand new and taken it out of the protective wrapper.

Page 12-Item #C - The driller attempted to use a factory diverter head but due to the materials encountered this kept plugging up. I do agree that the plastic sheeting was probably not the best deflection method available.

Page 12-Item #IIIA1 - The portion of the hole drilled with the Odex hammer provides a hole approximately 6" in O.D., however the portion of the hole that was drilled using the tricone bit only allowed a 4" O.D. The drilling was very tough, encountering rocks, concrete, wood etc. making Auger methods unworkable.

Page 13-Item #IIIA2 - No comment

Page 13-Item #IIIA3 - Maybe we should have drilled this project different but the Park City area geology usually has us use the Odex method. The geology changes very rapidly in the area and is hard to determine the best method in advance. I do not know how the consultant knows the screen was installed directly against the formation or that the hole caved, I believe this to be his opinion only and it seems to be slightly biased. The driller told me he figured his sand pack volume for all three wells and it came close to what it should have taken, this would indicate that caving no occurred.

Page 13-ItemIIIA4 - The outer casing was pulled in different lifts, but the consultant fails to mention that the filter pack material was in the casing and the material flowed around the screen as the casing was pulled. The casing was not pulled higher than what was left inside the casing.

Page 14-Item#IIIB1 - The equipment before entering the hole was cleaned and not left on the ground.

Page 14-Item#IIIB2 - The driller's helper did smoke on site, which should not have occurred, but he did so approximately 40FT from the hole, near the compressor.

Page 14-Item#IIIB3 - Tom does not remember if bare hands were used while developing, if so this is not good practice. The rope was allowed to lie not on the ground but only on the newly poured concrete pad around the well.

Boyles Bros. in no way has an indifferent attitude toward the state or E.P.A. procedures for installation of wells, we take the guidelines very seriously and try to follow all procedures as correctly as possible. All work preformed was under the direction of Ecology and Environmental personnel. Our site personnel noted a negative attitude with the consultant concerning the placement of wells at this site.

Memorandum

TO CORDEL Schmidt - REGION VIII TAT - DENVER OFFICE

FROM - HUSSEIN ALDIS

Subject - Monitoring well installation at the Richardson Flats Tailings Site, Summit Co., Utah TDD# T08-9204-015

Review of your report and the report by Pioneer Technical Services Inc. (PTS), Butte, Montana, reveals certain important discrepancies:

These include:

- apparently irreconcilable descriptions of geologic conditions observed during logging by the TAT, and those described by PTS in their text;
- the preparation of a cross-section by PTS which is not compatible with well logs prepared by the TAT and not substantiated by any alternative well logs;
- a plan of the site prepared by PTS which

places the monitoring wells at different distances from each other than does the PTS cross-section

- a claim by PTS that water in MW-02 will "flood" the landfill, coupled with the assertion that the water in MW-02 rose to "exactly 26.5 ft bgs" (below ground surface), while at the same time they assert that the split-spoon sample from 25-27 ft bgs in MW-02 was "clearly showing the top of the aquitard to be at 26.5 ft bgs"

The cross-section of the landfill which I have prepared (see attachment), implies that the elevations of water in the three monitoring wells a compatible with the interpretation, that they are

installed into an unconfined aquifer within a predominantly clay unit containing lenses and stringers of sand and gravel. Please check that the elevations and distances agree with your own surveys.

Very typically when drilling into sediments such as clay, the water table is not obvious during boring, and obviously saturated conditions are not encountered until well beneath the subsequently determined water table elevation. This is because the rate of flow of water into the borehole is slight, especially because of the compression of clays against the borehole wall. Also, with the method of drilling used, the upper parts of the hole are cased off. When left open for some time or when completed as a well, the slow leakage of water from the borehole wall results in the gradual rise of the water until equilibrium is established.

This can be demonstrated by the low rate of recharge of the wells even after development. The charge that MW-02 will "flood" the landfill is clearly absurd. Because no water is standing above the base of the fill at any of the wells, none can flow into it.

The implication that the fill has been "dry" since the time it was landfilled is essentially impossible. The fill is covered with gravelly soils, probably well to moderately well drained, and the climate of Summit County is certainly humid, with more than 100 inches of snow each year. The climatic data for a site comparable to Richardson Flats should be

collected, but I have no doubt it will show that ~~[illegible]~~ during snow-melt typically there is recharge to the ground-water. This means that the municipal fill within the former landfill is wetted yearly, and leachate is generated by, and discharged from, the landfill. Clearly it will go into Silver Creek, via the ground water, absent any leachate outbreaks.

To respond to the specific charges made by PTS:

- the guidance document is guidance, not regulations;
- PTS has alleged that the fill is 4 and has been dry, in contradition to the climatic conditions and the type of cover materials;
- PTS has alleged the existance of a confined

or semi-confined aquifer with insufficient evidence, and alleged that all the wells fully penetrated the "thick" aquitard under the landfill. They also alleged that the clay aquitard is continuous. None of these allegations is yet proven or even appears likely.

To definitely disprove the allegations that the clay layer is a continuous aquitard, which confines an artesian aquifer, and to show if the hydraulic head is sufficiently above the level of the base of the landfill to flow into it, up a well, will require additional work. One way would be to properly abandon MW-01 and install in its place two wells. One would be a

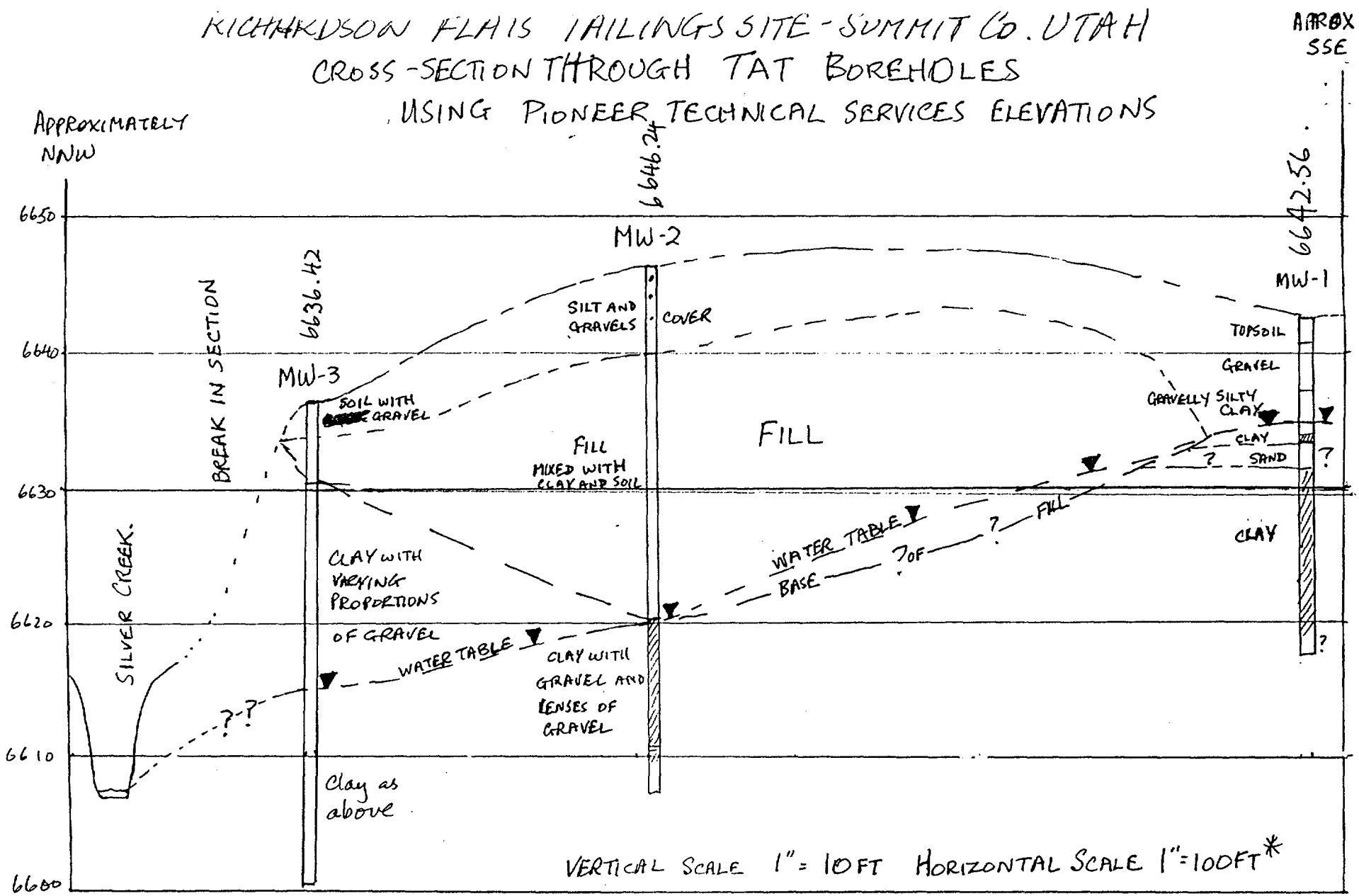
very shallow well, screened into the sand from 9-11 feet. The other would be installed with a surface casing cemented into the ~~clay~~ clay layer, and then extended to the first aquifer showing relatively high hydraulic conductivity. Both wells would have to be continuously sampled, preferably with a LASKEY ~~Laskey~~ sampler. This gives a 3-inch core, which gives much better rates of recovery than a 2-inch split-spoon sampler because it is less likely to be blocked by a cobble.
If the shallow well shows water at any time of this year, it shows infiltration into the landfill. If the deeper well shows a hydraulic head below the top of the clay, and lower than the shallow well, it shows a downward hydraulic

gradient, and one incapable of "flooding" the landfill at this point. However, one well will not show the hydraulic gradient in this aquifer, ~~and because of the closeness of the discharge area, (Silver Creek), this aquifer might~~ this would require three wells. Therefore, an alternative is to install three deeper wells, each adjacent to ~~the~~ an existing monitoring well, but cased off to the depth of the bottom of the well screens of the existing wells. If all three new wells show lower hydraulic heads than the wells they are paired with, then the whole landfill is a recharge area and the entire set of allegations is refuted. MW-3 is so close to Silver Creek that it might be within a discharge ~~zone~~

for the underlying aquifer, but the water level will certainly not reach even close to the base of the fill at this point.

The use by PTS of such terms as "calamity" "egregious violation" and "criminal negligence" are absurd and defamatory, besides being unsubstantiated. I am glad to hear that you will submit this for review by counsel, as some legal action against PTS may be warranted.

RICHARDSON FLAIS TAILINGS SITE - SUMMIT CO. UTAH
CROSS-SECTION THROUGH TAT BOREHOLES
USING PIONEER TECHNICAL SERVICES ELEVATIONS



* TAKEN FROM PIONEER TECHNICAL SERVICES CROSS-SECTION
Not from PTS PLAN which has different horizontal scale.
Note: BREAK IN SECTION

TDD # T08-9204-015